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On two HYMENOMYCETOUS FUNGI, *belonging to the Lycoperdaceous group, by the* REV. M. J. BERKELEY, M.A., F.L.S. (TABS. V. VI. VII.)

Few Fungi have as yet been received from Southern Africa; but, from the collections hitherto made in that country, it is evident that far the most striking feature is the variety of forms under which the Lycoperdaceous group presents itself to the notice of the mycologist. Not only the common European genera and even species occur, while the curious *Batarrea*, represented by the British species, accompanies them; but we have *Podaxon Carcinomatis** on the ant-hills, differing altogether in habit from any European genus, and several other forms, either more or less allied to those which have long been recognised, or quite unlike both in habit and character. It is to two of the latter that the attention of the mycologist is now directed, presenting as they do a most curious combination of characters and highly interesting matter for reflection as regards affinity.

One of these has already been shortly characterised by Kunze,† from whom I have received a beautifully-executed sketch and a portion of the hymenium, which leave no doubt as to the identity of my plant with his. The other, as far as I can discover, is altogether new to science. Both form part of the rich collection of Sir W. J. Hooker, by whom they have been kindly placed in my hands.

I shall proceed at once to the characteristics of the genera, reserving my remarks on their affinities to the close of the memoir.

SECOTIUM, *Kze.*

Volva universalis (-peridium) demum subobliterata. Stipes distinctus non cellulosus e fibris flaccidis compositus in speciminibus optime evolutis cum hymenophoro confluens. Hyme-

* The specific name is so spelt in the Linnæan Herbarium, where the original specimen remains in excellent preservation.

† Flora, 1840, p. 321.

nium subtus liberum gyroso-cellulosum, cellularum parietibus ab hymenophoro l. apice stipitis nascentibus et ab illis nequaquam discretis. Sporidia cum pedicello limoniformia cellularum parietes vestientia, nucleo globoso. Flocci nulli. Est ubi stipes non ad hymenophorum attingit sed ipse hymenio terminatur.—Fungus boletiformis terrestris Hymenangium stipitatum volvatum referens. Nomen ab σηκωτος *cellulosus* ductum.

Secotium *Gueinzii*, Kze. *Flora*, 1840, *p.* 322. (Tab. Nostr. v.)

In arenosis Promontorii Bonæ Spei detexit Gueinzius, 1839. In Uitenhage, Decembri, Zeyherus.

Volva universal, clothing the base of the stem and pileus, smooth, white, at length entirely vanishing below, and only to be seen satisfactorily in unexpanded specimens. Stem $2\frac{1}{2}$ inches high, obese below, about $\frac{1}{2}$ an inch thick at the point where the volva becomes free, soft and elastic, with the central fibres paler and less compact, composed of rather flaccid filaments, mixed with more slender filaments whose walls do not collapse, attenuated upwards, and then more or less expanded, either clothed above entirely by the hymenium, or continued into the very thin hymenophore, and connected with the hymenium on either side above the expansion. Pileus or hymenophore 2-3 inches broad, subhemispherical or ovate, unequal, clothed permanently with the volva, smooth, white, areolate, when dry, giving off, as well as the top of the stem, more or less numerous plates, continued from its substance, which ramify and form a spongy crumb-like hymenium, which is perfectly free below. Walls of the cells clothed with yellow-brown, lemon-shaped sporidia, about $\frac{1}{3500}$ of an inch in diameter, attached by a short peduncle, and containing a large globose nucleus. The apiculus at the top of the sporidia is seen only in certain positions. In one specimen the volva is torn off regularly at the base, and remains partially attached to the edge of the pileus within its cavity, under the form of a distinct ring. M. Kunze, in his letter on the subject, informs

me that he saw no trace of a volva in his specimens. But it is clear from his admirable sketch, that the stem was already elongated, and then no clear vestiges of the volva remain below. The walls of the cells are scarcely powdery, but coated with sporidia, exactly as in *Hymenangium*, to which genus *Rhizopogon albus* of Eng. Fl. as far as the specimen found by Klotzsch is concerned is certainly referrible. Bulliard's *Tuber album* belongs to a totally different group, being entosporous and not exosporous.

Polyplocium, *n. gen.*

Volva universalis ampla persistens. Stipes distinctus non cellulosus e fibris flaccidis compositus cum hymenophoro confluens. Hymenium subtus liberum gyroso-cellulosum, demum in processus grossos aculeiformes fœtiscens; cellularum parietibus ab hymenophoro nascentibus tandem discretis. Sporidia minuta copiosissima ovata nigra immixtis floccis tenuibus pellucidis parce ramosis cellulas implentia. Nucleus unus alterve globosus.—Fungus boletiformis terrestris fœdissime inquinans. Nomen a πολυπλοκος formavi.

Polyplocium *inquinans*. (Tab. vi. vii.)

In ripas fluvii Orange river dicti in Africa australi detexerunt *Domini Burke et Zeyher*.

Volva universal, clothing the base of the stem and pileus, smooth, white, at length bursting irregularly, and forming a broad ragged persistent cup, nearly 3 inches broad. Stem obese below, nearly six inches high, $2\frac{1}{2}$ inches thick at the point from whence the volva is given off, attenuated upwards, so as to be 1 inch thick where it joins the pileus into which it gradually expands, soft and elastic, consisting of closely compacted flaccid fibres, arranged more or less in fascicles, which terminate abruptly at the sides. Pileus 5 inches broad, hemispherical, clothed with the adnate volva, smooth, rather wrinkled, and areolate when dry, clothed beneath exactly as in *Boletus* with the cellular hymenium. The cells proceed from the substance of the pileus, and are arranged more or less vertically. In a portion of the hymenium they

separate into a number of coarse tooth-like processes, while in other parts the connexion of the cells is not broken; the whole hymenium at length easily separates from the pileus, exactly as that of *Boletus*. The cells are filled with an immense number of minute, dark purple-brown, or almost black sporidia, mixed with copious, pale, pellucid, slightly-branched, inarticulate flocci. The sporidia are ovate, with one or rarely two globose nuclei about $\frac{1}{6000}$ of an inch in diameter. The thickness of the flocci is somewhat less than that of the sporidia.

It may now be considered as a well-established fact, that the puff-ball group, however different in their mature state, form a part of the vast division of *Hymenomycetes*. In my memoir on the subject, I have stated that I was first led to suspect this to be the case, by the resemblance between the hymenium of a young *Boletus*, and that of a *Lycoperdon* in its early stage of growth. I was not however prepared to expect so striking a confirmation of such a view as that exhibited by the two genera described above. In general outward form, and in the disposition of the hymenium, nothing can be stronger than the resemblance between these genera and *Boletus*; and while in *Secotium* the hymenium is permanently united with the hymenophore, and the cells simply bear the sporidia, which are not extremely numerous on their walls without the presence of accessory flocci, in *Polyplocium* the hymenium at length is completely separable from the hymenophore, and more distinct from the stem, which is, as in *Boletus*, completely confluent with the pileus, and the mass of cells, which contain innumerable minute sporidia, accompanied by abundant flocci, is at length broken up, at least in parts, into hydniform processes.

The connexion exhibited between the *Tuberiform Hymenomycetes* and Boletus is scarcely less interesting. The hymenium of *Secotium*, as far as can be judged from dry specimens is as nearly as possible identical as to structure with that of *Hymenangium*. *Secotium* may be considered

theoretically as consisting of an *Hymenangium*, supported upon a stem, and protected by a volva; and the more the stem penetrates the *Hymenangium* (= Hymenium) the more close is the resemblance to *Boletus*. The genus *Gautieria*, which has no peridium, belongs apparently to the group of *Clavariæ*, approaching to *Sparassis*. If this notion be correct, there appears at present to be no known *Lycoperdaceous* genus, except those described above, in which a portion of the hymenium is perfectly free from any integument.*

Explanation of the Figures, Tabs. v. vi. vii.

Tab. v.—*Fig.* 1. Secotium Gueinzii, *nat. size*. *f.* 2. Vertical section of the same, *nat. size*. *f.* 3. Sporidia in different positions, *highly magnified*.

Tab. vi. vii.—*Fig.* 1. Polyplocium inquinans, *nat. size*. *f.* 2. Vertical section of the same, *nat. size*. *f.* 3. Flocci and sporidia, *magnified*. *f.* 4, 5. Ditto, *highly magnified*.

On some Entomogenous Sphæriæ. *By* Rev. M. J. Berkeley, M.A. F.L.S. (*with a Plate*, Tab. VIII.)

It has been long known that certain clavariæform fungi are produced on larvæ and pupæ of insects, and one species which has excited much attention is developed on full grown wasps. In the former cases it appears that the Fungus is uniformly produced on insects which have gone into the earth to

* Dr. Montagne has just sent me the characters of a genus very closely allied to the above, to which he assigns the name of *Gyrophragmium*. It is founded on *Montagnites Dunalii*, Fr. In external characters, it is nearly identical with *Polyplocium*, but there are no flocci with the sporidia. Dr. Montagne remarks, that the volva is in reality the lower part of the peridium, a remark equally applicable to *Polyplocium* and *Secotium*. It is, however, the same organ as the universal veil of a volvate *Agaric*. So close is the resemblance of the *Gyrophragmium* to many of the higher *Hymenomycetes*, that its affinity with *Lycoperdaceæ* escaped the notice even of the great Swedish mycologist. If any thing more were wanting to prove the alliance of *Lycoperdaceæ* to the higher *Hymenomycetes*, this fact alone would be sufficient.

undergo their transformation, and proceeds from the anterior part of the body. The Guêpes végétantes, as they are called, are wasps infested with a very long often twisted fungus, which, if we may believe what has been reported on the subject, without however giving heed to such fables as those of Father Torrubia,* at least commences its developement on the living wasp, and, according to Dr. Maddiana,† arrives at its full growth during the life of the insect, though at length reduced by its parasite to the last stage of debility.

Several species have been noticed, but three only at present are admitted. I have no doubt however that the production first noticed by Réaumur in Mémoires de l'Académie des Sciences, 1726, p. 302, under the name of Hia Tsao Tom Tchom, a drug much esteemed in China, whose properties are detailed by Duhalde, vol. 3, p. 490;—that by Watson and Hill in the Transactions of the Philosophical Society, 1763, vol. 53, p. 271, in their Memoir on Mouches Végétantes des Caraibes, and admirably figured by M. Fougeroux de Bondaroy in Mémoires de l'Académie Royale des Sciences, 1769, Mémoire sur les Insectes sur lesquels on trouve des plantes; and thirdly the parasite of the guêpes végétantes are so many distinct species. A fourth and most extraordinary species is one sent by Dr. Joseph Hooker from Australia.

Unfortunately in none of these species have I been able to detect perfect asci and sporidia, by which probably they would be as well characterised as the already described species. The characters therefore given will be necessarily imperfect; but my object is not so much to establish the species as to collect them together, leaving to future observers the task of completing what I am unable to render perfect. When the genus *Sphæria* shall have been revised, all will be arranged in *Hypocrea*.

1. Sphæria *militaris*, Ehrh.

* Apparato para la Historia Natural Española in Madrid. 1754.

† Annals of Lyceum of Nat. Hist. of New York, vol. i. pt. 1. 1824. p. 125.

2. Sphæria *sphecocephala*, Kl. *in Hook. Herb.*; lenta, pallida, stipite longissimo tortuoso: capitulo brevi subclavato.

Jamaica, *Dr. Bancroft*. St. Vincents, *Rev. Lansdown Guilding*. And in other islands of the West Indies.

The whole appearance of this species is very different from that of any state of *Sphæria militaris*. The name given to it by Klotzsch with the authority of Künze attached to it, is clearly a wrong transcription of Künze's name in Myc. Hefte, for a somewhat analogous form of *Sp. militaris*; viz., *S. sphærocephala*. It is, however, so good that I have retained it. It is much to be desired that correct information should be obtained by some one resident in the West Indies as to the developement of this species, and more perfect specimens procured than those in the collections of the British Museum, and Sir W. J. Hooker, to which alone I have had access. The heads in these are dotted with the young perithecia, but there is not the slightest vestige of asci or sporidia.

3. Sphæria *entomorrhiza*, Dicks.

4. Sphæria *sobolifera*, Hill (sub Clavariâ) carnosa, pallide fusca; capitulo subgloboso, stipite æquali tereti prolifero.

Clavaria sobolifera, *Hill. Vide Watson and Hill in Phil. Trans. vol.* 53, *p.* 271, 1763. *tab.* 23. *Edward's Gleanings of Nat. Hist. tab.* 335. *Fougeroux de Bondaroy, Mém. de l'Acad. des Sc.* 1769. *tab.* 4. Guadaloupe, Martinica, Dominica on the nymph of a species of *Cicada*. There are several specimens in the collection of the British Museum.

This species is extremely variable in form, but in its most perfect state has a subglobose head and proliferous stem; sometimes the terminal head is not developed and the stem is terminated by a number of little heads, which form a cluster as in a recorded variety of Sph. militaris; sometimes the stem is branched above, each branch being terminated by a little clavate head; sometimes a single head only is developed but tuberculated, and in this case there are no proliferous processes on the stem; and occasionally not only the stem is even, without any proliferous processes but the

head instead of being subglobose is absolutely linear as in the two following species. I have in vain examined specimens both dry and preserved in spirits in the hope of finding perfect asci, but the perithecia, though tolerably well formed, contained merely a few threads which broke up into short cylindrical portions. These are probably imperfect strings of sporidia, and if so differ materially from those of Sp. entomorrhiza and *Sp. Robertsii.* The greater part of the figures in plate 5 of Fougeroux' Memoir belong probably to *Sp. entomorrhiza.* The substance figured on a perfect Cicada is a secretion as Mr. Gray showed me in several species in the British Museum.

5. Sphæria *Sinensis*, n. s.; Fusca, stipite cylindraceo deorsum subincrassato; capitulo cylindrico cum stipite confluente apiculato; apiculo sterili. (Tab. VIII. fig. 11. *a. b. c. d.*)

Hia Tsao Tom Tchom. *Réaumur Mém. de l'Ac. des Sc.* 1726. *p.* 302, *tab.* 16. *Rees' Cycl. vol.* 17.

Hia Tsao Tong Tchong. *Duhalde. China. vol.* 3, *p.* 490.

Hea Tsaon Taong Chung. *Westwood, Ann. of Nat. Hist. vol.* 8, *p.* 217.

China. *Mr. Reeves.* Collection of Brit. Mus.

Attached by simple or very sparingly branched, very slender flexuous inarticulate threads, which spread more or less over the surface of the caterpillar. The substance of the caterpillar is replaced by a tough mass of very fine branched threads, which are far more compact than those in the substance of the fungus, mixed with colourless oil globules. The head is sometimes split into two or three linear portions.

This species is a celebrated drug in the Chinese Pharmacopœia, but from its rarity only used by the Emperor's Physician; it resembles in its properties those of Ginseng, being a strengthener and restorative, but does not like that cause hemorrhage. Father Perennin states that he was raised from a state of extreme weakness by the use of this medicine, which was administered, dressed in the body of a duck. The Chinese name refers to the notion that it is a

herb in summer and a worm in winter. The specimens figured by Réaumur were imperfect, and therefore their true nature was not recognised, but the fungus was supposed to be a portion of the root of some plant to which at a certain stage of growth the caterpillar attached itself. It is sold in little bundles tied up with silk. I have seen several of these, but have not been able to find any in which the perithecia were fully developed.

Tab. viii. fig. I. I. Sphæria Sinensis; *nat. size:* one specimen with the head longitudinally splitting. *a.* radiating appearance of a fractured stem; *b.* filaments from the base of the stem; *c.* globules from the body of the caterpillar; *d.* filaments forming the central substance of the fungus-bearing caterpillar—all more or less highly *magnifid.*

6. Sph. *Robertsii,* Hook.—Sp. Hugelii. *Corda. Ic. Fasc.* 4. *cum opt. analysi.*

On the larva of *Hepialus virescens,* Doubleday. New Zealand.

The following valuable information was transmitted by Dr. Joseph Hooker, of H. M. Discovery ship, Erebus. "About *Sphæria Robertsii* I collected all the information and as many specimens as I could, but am still much at a loss to account for its developement. They are found in spring generally under tree ferns; the caterpillar is buried in the ground as is the lower portion of the fungus. Now both these fungi (i. e. this and the following species) belong to caterpillars which bury themselves for the purpose of undergoing the metamorphosis; and both Mr. Taylor and Mr. Colenso hold the same opinion that in the act of working the soil, the spores of the fungus are lodged in the first joint of the neck, and the caterpillar settles head upwards to undergo its change, when the vegetable developes itself. I do not remember, you have remarked in your "Icones," that the entire body of the insect is filled with a pith or corky vegetable substance, and that the intestines are displaced, which my specimens in spirits shew well, and then what does the muscular fibre of the animal become? It must I suppose be all turned into vegetable, for the skin of the creatures re-

mains quite sound all the time. This change may take place from the displacement of one gas and developement of another; it also occurs in the dark, and is hence somewhat analogous to the formation of Fungi on the timber-work in mines. However this may be, the whole insect seems entirely metamorphosed into vegetable with the exception of the skin and intestines."

As in silk-worms attacked by *Botrytis Bassiana*, it is most probable that the caterpillar lingers a short time till the vital organs are clogged up with the mycelium. It does not appear that in any case it has made any progress with its coccoon. We are indebted to Mr. Dieffenbach for the knowledge of the moth to which the larva belongs.

7. Sphæria *Taylori*, n. s. stipitibus fasciculatis connatis anastomosantibus; stromate breviter pamato rufo fulvo subtiliter velutino; ramis compressis; apicibus acutiusculis. (Tab. viii. f. II. *a, b. c.*)

Banks of Murrambidgee. Australia. *Mr. Adams.*

Springing from the head of an extremely large caterpillar. About six stems grow from the same point, forming a compact cylindrical mass $2\frac{1}{2}$ inches long, $\frac{3}{4}$ of an inch thick, connate slightly branched and anastomosing; expanding slightly upwards, and giving off a branch of short much compressed forked and palmate branches, which are dotted above with the perithecia. The apices are somewhat pointed. The colour of the whole is a deep red brown, inclining to tawny when dry. The whole of the branches are clothed with a very thin coat of extremely short forked irregular flocci, which give the surface a dull appearance when dry. They are at first solid, but at length become hollow. A portion of the caterpillar is filled with a white corky substance, for the root is more or less coated with a spongy mass, consisting of very slightly branched wavy threads.

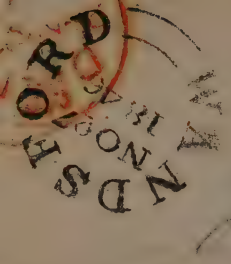
The only specimen I have seen was not mature, but probably arrived nearly at its full growth as the incipient perithecia were evident towards the tops of the branches.

The following notes are from a letter of Dr. Joseph

Hooker:—The information he states was received from the Rev. Mr. Taylor of Waimate. "This caterpillar Fungus was picked up on the banks of the Murrambidgee River, 10 miles from the township of Yap (in New Holland) in a rich thick alluvial soil, with many others of the same kinds. When fresh it was 8 inches long, and 3 inches of the fungus from the nape of the neck were buried under ground, on the surface of which is the oval or circular flower-like bunch of branches of a brown velvety appearance when fresh. The caterpillar has a great resemblance to the green wattle caterpillar, which produces a large brown moth. The discoverer Mr. John Allan, the only person who has heard of it, found many empty holes near, as if the chrysalis had been hatched, and he saw many empty shells of these grubs scattered about the same place, and at night the brown moths were so nume rous as to be quite troublesome. The body of the insect was solid and pithy; the outer skin attached to the substance of the centre which has no roots in it; and moreover the pith is of the same substance as the stem, which is as thick if not thicker than the body of the caterpillar. Both the pith and stem when burnt have a strong animal smell. Mr. Allan saw nearly 30 about March, 1837.

Tab. viii. fig. II. Sphæria Taylori, *nat. size; a.* a. magnified branchlets; *b.* filaments of sponge about the root, highly *magnd.; c.* do. from velvety surface, *do.*

I cannot close my paper without due acknowledgement to Mr. I. E. Gray and Mr. White of the British Museum for their kind assistance in the prosecution of my inquiries. Several other fungoid productions on insects are preserved in our National Museum, but none certainly referrible to the genus Sphæria.



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